XLI.—*Report of the Results of Researches in Physiological Botany made in the year* 1839. By F. J. MEYEN, M.D., Professor of Botany in the University of Berlin.

[Continued from p. 177.]

2. *In the Cryptogams.*

M. UNGER * has published an interesting treatise on the structure and functions of the organs of fructification of *Riccia glauca*; he first notices the anatomical structure of the foliaceous substance, and shows that the want of stomata is made up for by the loose conjunction of the cells on the surface (this formation of the upper cells is particularly evident in *Riccia crystallina,* Meyen). Then follows the description of the observations of the development of both kinds of organs of fertilization; but the first stages of their appearance have not been observed, because, as M. Unger says, the proper time was already passed. The sporiferous organs (called Pistils, Meyen) always appear in a large air-cell, and are said to arise by the conjunction of a group of parenchymatous cells, which during their increase and enlargement form a cavity in their centre, which exhibited only one opening outwards. This bottle-shaped organ lengthens its neck until it reaches the surface of the thallus, and now the enlargement of the lower part of the sporangium commences (which is formed by the ovarium of the pistil). The contents of the sporangium appeared first as a homogeneous, colourless, fluid matter, and as a granular substance; this collected gradually in the middle, and then appeared as contents of that cellular tissue out of which the primitive cells of the spores are formed.

It appeared also as a general fact, that at the periphery one layer of cells produces no spores in their interiors (here also a similar case of cells as in the formation of pollen in the anthers of the Phanerogams, M.). In the structure of the spores, M. Unger confirms the statement that the outer brown skin is not composed of cells, but is only a reticulate deposition of cellular matter.

The other organs of generation, the so-called anthers, were not found in such great numbers; they were dispersed, and occurred singly. They are said to consist in a regular separation of the parenchymatous cells of the thallus: here also the contents form a granular substance, which appears in the

* Anatomische Untersuchung der Fortpflangungstheile von *Riccia glauca,* Linnæa, p. 1 to 17.

form of cells of extraordinary smallness, as in the anthers of the Mosses.

M. Unger draws the following results from his observations:—

1st. That the original development in *Riccia glauca* of both those organs is simultaneous, and that they therefore seem to have a nearer relation to each other. 2nd. That both organs represent cavities formed from cellular tissue, which are provided with lengthened openings, and that therefore a *material* communication of their contents is not improbable. 3rd. That the function of the neck-shaped passage of the sporangium is confined to the earliest period of its development, etc., and that, finally, the transference of the contents of the anthers to the sporangia is a cause of the formation of spores.

M. Mohl has published some new and very fruitful observations on the development of the spores of the *Jungermanniæ*: he chose for his experiments *Anthoceros lævis*, in which the primitive spore contains but few globules, which renders the progress of the formation easier to follow. The youngest primitive cells which M. Mohl found appeared as transparent, partly spherical cells, in which one could observe a cell-nucleus, as in the phanerogamic plants. Afterwards a gummy substance was formed round the disc of the nucleus, and this finally covers more than half of it; the green granules appear more plainly, and the mass divides into two parts. At the edges this green mass passes into a colourless, gummy, but fine granular substance, which forms larger or smaller meshes; M. Mohl compares this substance very correctly to the bladders of foam. After this divided green mass has gradually increased, these two halves divide again into two parts, and thus four nuclei, lying close to each other, are formed (grain-cells, M. Mohl calls them), in which change the true cell-nucleus takes no part, but lies separated by itself. At the same time the side of the primitive cells thickens, and adopts the form of the well-known mucous substance, and now follows the division of its cavity. Lines are formed on the inner surface of the primitive cell, which are correctly represented as projecting edges, which afterwards grow towards the middle of the cell between two masses of granules, and join together. After this division, nothing is visible of the nucleus. A short time after the division of the primitive cell, the formation of the spore-cuticle commences, namely, in each of the four compartments, and the granular masses lie in the interior of each of these new-formed cells, and are fastened by threads of gum to the circumference of the spore-cuticle. The remaining observations agree with the results of former ones, and are already known. A series of excellent delineations accompanies the paper. M. Mohl then proceeds to compare his view of the formation of the spores with that of M. de Mirbel. According to the view of the latter, the formation of the spores depends principally on the primitive cell, for the contents are divided mechanically into four parts by the projecting partitions. According to M. Mohl's earlier idea, the development of four spores in a primitive cell depends solely on the organic change of the contents; but his late observations on *Anthoceros* appear to support an intermediate view, for the development of the partitions is produced by that of the contents of the primitive cell. Finally, M. Mohl endeavours to show that no great importance must be attributed to the circumstance of the four divisions of the primitive cell communicating with each other or not, and that we must not consider this process as a characteristic distinction between the primitive cells of the spores and those of the pollen-grains. In *Anthoceros lævis* M. Mohl could not observe this division; in *Anth. punctatus* he thinks he saw it, and also in *Jungermannia epiphylla*, but not in *Riccia glauca*. I have published the results of some new observations on the formation of the spores of *Aneura pinguis*, which may be regarded as a sequel to those spoken of in the third volume of my 'Physiology' (Berlin, 1839). In the first stages of the fruit there were found only very tender long cells, which were imbedded in a gummy matter; these cells enlarged, and at length lay close to each other, and at a later period it was seen that from these at first perfectly homogeneous cells, not only the elaters, but also the spores, were formed; some become elaters, and others undergo a series of changes, until at length the spores are produced. The cell out of whose division four spores are always produced, I have called primitive spore (Mutter-spore), and of these primitive spores, three, four, or even five are formed in each tubular cell; whilst those neighbouring cells which afterwards produce the formation-tunic retain their granular contents unchanged, until the spores are perfectly developed. As soon as the primitive spores are formed, a gelatinous membrane appears at their periphery; this has been called primitive cell; I designate it as formation-tunic or skin (Bildungsbrülle). Some time afterwards I observed two, three, or even four primitive spores enclosed in their formation-tunics, connected with each other in a row, and occupying the place of the original tubular cell, but from want of material I could not determine whether these formation-tunics were derived from the single members into which the primitive tubular cell may by transverse division be dissolved, or whether, as appeared in some cases, the primitive spores with their coverings make their appearance within the tubular cell, whose sides are then absorbed. The drawings accompanying the article will make this clearer. Sometimes only a part of the tube is changed into primitive spores, etc., and the rest remains undeveloped in one of the primitive cells of its own tube, by which the appearance of stalks sometimes seen on the single primitive cells is explained: as the primitive cell is absorbed, they also disappear. In several fruits of *Aneura pinguis* I was able to observe, at the time when the division of the primitive spore by the contraction of the sides takes place, the existence of a second formation-tunic (it was not the inner surface of the outer one), but neither of them took any part in the division of the spore, as is seen in the delineations. However, last winter I observed that they did take part in the division of the spores in individuals of *Aneura pinguis* (the large turf variety), inasmuch as the gelatinous membrane entered into the contractions of the membranes of the primitive spores, but was never completely separated, as is the case with *Pellia epiphylla*. Whether in *Aneura* the formation of nuclei precedes the division of the primitive spore into four others cannot be observed, inasmuch as these cells are filled with a green matter which prevents our seeing the internal process: I have also not been able to observe it in *Pellia epiphylla, Sphagnum palustre*, etc. Directly after the production of the spore by division, each one exhibited a peculiar formation-tunic, just the same as the pollen-grains; at a later period both the common formation-coverings, as also the special ones, are absorbed, and then the spores lie singly between the tubular cells, which at this time change into elaters *.

In the past year M. Klotzsch has described a series of Fungi, and accompanied his descriptions with excellent delineations†; in this work (to plate 473) we have a division of the *Hymenomycetæ* according to the new observations on the structure of the hymenium. The *Hymenomycetæ* may be divided into two groups: *Exosporæ*, with free stalked spores, and *Entosporæ*, with enclosed unstalked spores. The first division is resolved into the *Tetrasporidei*, where the straight

* The plant used for the above observations was the so-called *Trichostylium arenarium*; but I have convinced myself that Corda's genus *Trichostylium* is the same as *Aneura*, for the small column which occurs in *Trichostylium* also belongs to *Aneura*.

† Aeb. Dietrichs Florades Königreichs Preussen, vii., Berlin, 1839, tab. 457-476.

spores are developed in fours, and only by way of exception in twos, threes and sixes; and the *Monosporidei,* where the long bent spores are always developed singly on spike-formed supports: the genus *Enidia* belongs to this group.

Interesting is the information that many tuberose Fungi, as, for instance, the genera *Gauteria,* Vallad., *Hydnangium,* Wallr., and *Hymenangium,* Kl. (*Tuber album,* Bull.), belong to the true *Hymenomycetæ,* and indeed to the *Exosporæ*; in these Fungi the hymenium covers the surface of the cavities which are found in their fleshy substance.

In describing the *Moschella esculenta,* M. Klotzsch calls the paraphyses of authors anthers; and of *Sphærosoma* (*fuscescens*) he says, that the anthers, when they appear in the Octosporidei, always project above the surface of the tube-skin (Schlauchkant), and therefore he does not reckon the paraphyses of *Sphærosoma fuscescens* (plate 464) as anthers, inasmuch as they do not project above the surface. I must here call to mind Carus's notice of a difference of gender in *Pyronema Marianum,* where the yellow colour of the whole surface of the fungus is derived from the contents of the paraphysæ, or anther-like organs.

Dr. Redmann Coxe has sent to the Linnæan Society his 'Observations on some Fungi or Agarici*,' which by deliquescence forms an inky fluid, drying into a bistre-coloured mass, capable of being used as a water-colour for drawings, and of a very indestructible nature, by means of common agencies.

M. Morren † has communicated some observations on the structure and colouring of *Agaricus epixylon,* DeC. As regards the colour, he says that the colouring substance is formed quite differently in Fungi to what it is in other plants; in the above-mentioned *Agaricus* the blue colour of the pileus is produced by a few spherical globules contained in the tubes of the tissue. These globules are not changed by iodine. In the deeper-seated layers of cells the globules are less numerous, and in the tubes of the white flesh of the mushroom they are not to be found. The tissue of the above-mentioned fungus is said to consist solely of anastomosing vessels, which have sometimes nodular swellings, and are generally forked, but seldom triramified: these vessels are long, cylindrical, anastomosing tubes; they contain a fluid and globules, and have here and there partitions. The tubes are of great length, and form a woolly tissue, and cannot there-

* Annals of Natural History, June 1839, p. 258.

† Notice sur l'histologie de l'Agaricus epixylon. Bulletin de l'Académie Royale de Bruxelles, vi. No. 1.

fore be reckoned to the parenchym; they appear most similar to the lacteous vessels, and form a true vascular tissue. One might place this fungous tissue together with the lacteous vessels (to which M. Morren has given the name of Cinenchyme, *κινησις*); but as it differs from these in the want of the circulation, as well as in its woolly interwoven appearance, M. Morren has called it Dædalenchyme.

I cannot agree with M. Morren's views of the nature of the fungous tissue: I consider it as cellular tissue, and have already described it (Phytotomy, 30, p. 138) as a peculiar form of irregular cellular tissue under the name of Felt-tissue. The cells are often long and branched, but the partitions which change these tubes into cells cannot be overlooked. Several kinds of regular cellular tissue are found in Fungi. M. Morren observed a spontaneous motion in the spores of *Agaricus epixylon* as soon as put into water. [This motion has however been already observed, and has been seen even in dry fungus-spores.—*Meyen.*]

In the foregoing Reports we have often made mention of a fungus formation which of late years has attracted so much attention, viz. Fermentation fungus: I have often attempted to prove that it is improbable that this fungus should be the cause of fermentation, although always found in fermenting liquids; but the fact of their being plants appears, to me at least, to have been fully proved by the observations on their increase and growth. However, M. Liebig*, in a treatise on Fermentation, etc., has declared those statements of the vegetable nature of the fermentation formations to be a delusion; and considers that gluten and albumen, which, during the fermentation of beer and vegetable saps, are separated in a changed state, appear in the form of globules, which swim about either singly or several together, and that these globules have been mistaken by natural philosophers for Infusoriæ and Fungi. Indeed, says Liebig, the idea that they are animals or plants disproves itself, for in pure sugar-water the seeds of the plants disappear during fermentation; the fermentation takes place without the appearance of a development or reproduction of the seeds, plants or animals which have been regarded by philosophers as the cause of the chemical process.

I am not aware upon whose observations Liebig grounds these latter statements; probably they are his own, which, however, must evidently give way to the more correct ones of his predecessors.

* Uber Gährung Fäulniss und Verwesung und ihre Ursachen. Annalen der Pharmacie, 1839.

M. Balsamo Crivelli has published some new observations on the origin and development of *Botrytis Bassiana**, and of another parasitic kind of mould, a subject which was treated of in our Report for 1836 (Berlin, 1837, p. 107). M. Crivelli found that the vesicles of which the fat consists can pass into *Botrytis*, and he convinced himself that the "corps vésiculaires" of M. Audouin were nothing more than swimming fat globules. A cut was made in the side of a fat caterpillar, and the exuding sap exhibited the supposed vesicular bodies of Audouin, which were certainly nothing but globules of fat. The following morning the interior of the caterpillar was covered with *Ascophora mucedo*. The spores of *Ascophora* were introduced into the bodies of four chrysalises, and three days afterwards the grains of fat could be seen full of vegetating filaments. Finally, M. Crivelli retains his idea, that in the fat of the silkworm there can take place such changes as to render its component parts capable of spontaneously producing mould, which property the fat may then impart to healthy caterpillars.

M. Turpin† explains why butter which has been melted and allowed to cool becomes so seldom mouldy: the treatise is of great length, for he mentions a number of cases in which mouldiness was observed without being able to assume that the seeds proceeded from the air; also the microscopical structure of butter, both before and after its fusion, is most circumstantially described. The following points may be mentioned: the mould which, in common butter, is produced from the lacteous globules contained therein cannot be produced in melted butter, because these globules are then covered with the oil of butter. M. Turpin remarks, that the explanation of the production of mould on the surface of organic matter by a continual 'rain' of seeds of all kinds of mould must at present appear ridiculous; but that the explanation by 'generatio spontanea' must be very limited, and also more clearly defined. Nature produces the mould in two ways: either directly out of the globuline of organic matter when this has ceased to be under the influence of vitality, or from spores which it produces itself.

M. Hanover‡ has made 'Observations on a Contagious Conferva Formation on the Water Salamanders;' he saw the

* Communicated by Freiherr von Cesati in the Linnæa of 1839, p. 118-123.

† Sur le singulier caractère physique et microscopique que prend le beurre, etc. Comptes Rendus du 9 Dec., p. 748-762.

‡ Müller's Archiv für Anatomie, 1839, Heft 5.

production of Confervæ on an anatomized specimen of 'Triton punctatus' while under water. Similar formations were observed on a dead salamander, a dead fly, and on the surface of several wounds which were made on living salamanders; sometimes the formation took place without there being any injury, *e. g.* on the toes, by which the toes attacked were destroyed.

[The plant observed by M. Hanover is the *Achlya prolifera*, Nees v. Esenbeck; and if, as M. H. says, M. Carus's figures do not agree with his plants, perhaps those will which I gave to Göthe's 'Mittheilunger aus der Pflangenwelt' (S. Nova Acta Acad. C. L. C. tom. xv. pt. ii. p. 374, etc. tab. i. xxix.), and in other places. I have seen this fungus under similar circumstances on flies, spiders, earthworms, Planariæ, dead frogs, and even on putrifying *Viscum album*; and have shown, in Wiegmann's Archiv, etc., 1835, ii. p. 354, that the little fungus which is formed about autumn on the body of the common house-fly has spores which germinate, and in water grow out into *Achlya prolifera.* The seed-formation and the germination of the *Achlya* spores were observed and represented in the above plate, as also in my 'Physiology,' iii. tab. x. fig. 18 and 19.—*Meyen.*]

M. Hanover inoculated the above plant on the back of a healthy animal, and saw that the formation of Confervæ had commenced at the end of sixteen hours, but fell off with the epidermis. The experiments were frequently repeated, but it was always found that the development of the plant was not injurious to the life of the animal. Moreover, M. H. remarked that the inoculation succeeded better with unripe than with ripe Confervæ.

As I have occupied myself very considerably with this subject, I may be allowed to mention my observations without prejudice.

The inoculation effected by M. Hanover is nothing more than a common propagation; the ripe plants afforded seeds, out of which other plants were produced, and the so-called unripe Confervæ increased their single threads, as is done by the order *Achlya* among the water Fungi, and by *Vaucheria* among the Confervæ. The growth of the fungous threads from the mucous surface of the *Tritoniæ* cannot be injurious; they grow like mould from dispersed spores. But just as the lower moulds are produced not only from spores, but also in a manner as yet unknown to us, so it is the case with *Achlya prolifera* and the *Isariæ*; they are moulds, which are developed as a product of a sickly state of the animal; the disease itself is deep-seated, for the animals generally die of it. When this mould is once formed, it propagates itself by spores. Such diseases are probably not rare, and only of importance to the animals. I have lately observed a disease of the Vibrio, out of whose body a very beautiful but small microscopical mould was developed, from which they died; the animals twist themselves in all directions, and try to get rid of the diseased product, but in vain; at length they become quiet and die.

[To be continued.]

XLII.—*On the* Urari, *the Arrow Poison of the Indians of Guiana; with a description of the Plant from which it is extracted.* By Robert H. Schomburgk, Esq.*.

More than two centuries have elapsed since the curiosity of Europe was raised to become acquainted with the plant from the juice of which the Indians make their celebrated Urari poison; and as the preparation has been enveloped in great mystery, all the attempts hitherto made have only added considerably to the wish of the learned in Europe to be able to sift the true from the fabulous accounts.

Raleigh appears to have been the first who heard of this substance, with which the Aborigines poisoned their arrows for war and the chase; and Father Gumilla observes, that "its principal ingredient was furnished by a subterraneous plant, a tuberose root, which never puts forth leaves, and which is called the *root* by way of eminence, *raiz de si misma*; that the pernicious exhalations which arise from the pots cause the old women to perish who are chosen to watch over this operation; finally, that these vegetable juices never are considered as sufficiently concentrated till a few drops produce at a distance a repulsive action on the blood. An Indian wounds himself slightly, and a dart dipped in the liquid Curare is held near the wound; if it makes the blood return to the vessels without having been brought into contact with them, the poison is judged to be sufficiently concentrated." Not less eccentric are the accounts which we receive from Hartzinck†, who was informed that, in order to try whether the poison be good, a poisoned arrow is shot into a young tree; if the tree shed its leaves in the course of three days the poison is considered strong enough. He observes further, that in the last rebellion of the Negroes in Berbice, a woman

* Communicated by the Author.

† Beschryving van Guiana, door J. J. Hartzinck, etc. Amsterdam, 1770, vol. i. p. 13.